

CLAIMS

1. An annotation system for graphically annotating measurement waveforms in a
5 signal measurement system having a graphical user interface through which
waveforms and measurement results are displayed on a display of the signal
measurement system, the annotation system constructed and arranged to enable an
operator to graphically generate an annotation label containing operator-generated
information and to graphically alter the position of said annotation label such that said
10 annotation label is positionally associated with a desired feature of a waveform
displayed on said graphical user interface.
2. The system of claim 1, wherein said information is predefined.
- 15 3. The system of claim 1, wherein said information includes graphical
representations.
4. The system of claim 1, wherein said information is presented in one or more
forms comprising at least one of textual and symbolic form.
- 20 5. The system of claim 1, wherein said information is provided by the operator
using a keyboard.
6. The system of claim 5, wherein said keyboard is a physical keyboard
25 operatively coupled to the signal measurement system on which the operator types the
desired information.
7. The system of claim 5, wherein said keyboard is a graphically-displayed
keyboard on which the operator graphically selects displayed keys of the graphical

keyboard through use of a cursor controlled by a pointing device operatively coupled to said signal measurement system.

5 8. The system of claim 1, wherein the information is entered by the operator through a voice recognition system.

9. The system of claim 1, wherein the operator can control appearance characteristics of said plurality of annotation labels displayed on said graphical user interface.

10 10. The system of claim 1, wherein said desired location of said plurality of annotation labels includes positions that positionally associate said displayed annotation labels with a desired waveform or waveform feature displayed on said graphical user interface, and

15 wherein one or more of said plurality of annotation labels includes additional graphical elements to facilitate visual association with said desired waveform or waveform feature.

11. The system of claim 1, wherein said annotation label is implemented as dialog box in said graphical user interface.

20 12. The system of claim 1, wherein said annotation label is implemented as a window in said graphical user interface.

13. The system of claim 1, wherein said annotation system comprises:

25 a plurality of label control units each constructed and arranged to control operator interactivity with an associated annotation label rendered on the graphical user interface, said plurality of label control units providing the operator with the capability to determine content and display location of said associated annotation label; and

an annotation label manager constructed and arranged to provide centralized control over invocation and removal of each of said plurality of label control units and, hence, of said display of said associated annotation labels.

5 14. The system of claim 13, wherein said annotation label manager maintains, in a label state data structure, a current state of each of said plurality of associated annotation labels currently rendered on said graphical user interface, said current state including said position and said content of said displayed annotation labels.

10 15. The system of claim 13,
wherein the label control unit is constructed and arranged to enable the operator to determine an appearance of said plurality of displayed annotation labels.

15 16. The system of claim 15, wherein said annotation label manager maintains, in a label state data structure, a current state of each of said plurality of associated annotation labels currently rendered on said graphical user interface, said current state including said appearance of said displayed annotation labels.

20 17. The system of claim 16, wherein said label state data structure is globally accessible to other elements of the signal measurement system.

18. The system of claim 13, wherein said graphical user interface displays at least one first display element in connection with a displayed annotation label, said graphical user interface generating function calls to said label control unit associated with said displayed annotation label in response to a graphically selection of said first display element.

19. The system of claim 18, wherein said graphical user interface further displays at least one second display element not in connection with a displayed annotation

label, said graphical user interface generating function calls to said annotation label manager in response to a graphically selection of said second display element.

20. The system of claim 19,

5 wherein said function calls provided to said plurality of label control units from said graphical user interface related to creation and deletion of said plurality of annotation labels are forwarded to said annotation label manager.

21. The system of claim 20, wherein said annotation label manager is constructed
10 and arranged to generate, in response to said creation and deletion function calls generated by said graphical user interface, system calls that cause an operating system to create and destroy specified ones of said label control units.

22. The system of claim 15,

15 wherein function calls provided to said plurality of label control units from graphical user interface relevant to said appearance of said associated annotation labels are forwarded to said annotation label manager.

23. The system of claim 13, wherein said annotation label manager stores in a
20 memory device default values for said location and said content of said displayed annotation labels.

24. The system of claim 15, wherein said annotation label manager stores in a
25 memory device default values for said location, said appearance and said content of said displayed annotation labels.

25. The system of claim 24, wherein said default values are dynamically maintained in real-time, updated to reflect recent selections of the operator.

30 26. The system of claim 14, wherein said current state comprises:

a label number uniquely identifying each displayed annotation label;
a label pointer providing an address of said label control unit that generated
said annotation label;

location information identifying a current location of said annotation label on
5 the display; and
label content information identifying contents of said annotation label.

27. The system of claim 26, wherein said current state further comprises:
rendering information identifying an appearance of said annotation label when
10 said annotation label is rendered on the graphical user interface.

28. The system of claim 27, wherein said current state further comprises:
a reference symbol identifier that identifies a location of a file that contains a
graphical symbol that visually associates said annotation label with a graphical
15 element displayed on the graphical user interface.

29. The system of claim 27, wherein said rendering information comprises:
text color identifying a color of text rendered in said annotation label; and
background color identifying a color of background area of said annotation
label.

30. The system of claim 29, wherein said rendering information further comprises:
a font specification identifying a font size of text rendered in said annotation
label.

31. The system of claim 30, wherein said rendering information further comprises:
an outline specification identifying whether a predefined border is to be
rendered around said annotation label.

32. The system of claim 23, wherein said default location has a first value that causes said annotation labels to be located at an origin of said display.
33. The system of claim 20, wherein the default location has a second value that causes said annotation labels to be located at a current position of the cursor.
34. The system of claim 16, wherein said label control unit reconciles positional conflicts between new annotation labels and currently rendered annotation labels, said location of said annotation labels stored in said label state data structure.
35. The system of claim 13, wherein said annotation system restricts said location of said plurality of annotation labels to locations entirely within said waveform display region, said restriction based on rectangle limits data identifying dimensions of said waveform display region, said location and size of each of said plurality of annotation labels.
36. The system of claim 13, wherein each said label control unit comprises:
a display controller constructed and arranged to interoperate with said graphical user interface to display and control said display and operator interactivity with said associated annotation label on said graphical user interface; and
a position controller constructed and arranged to control said location and size of said associated annotation label.
37. The system of claim 36, wherein each said position controller is constructed and arranged to determine a size and position of said associated annotation label to enable said associated annotation label to be completely rendered within boundaries of a waveform display region.
38. The system of claim 36, wherein each said label control unit further comprises:

a command processor constructed and arranged to route certain function calls from said graphical user interface to annotation label manager and forwards certain commands to said display controller and to said positional controller.

- 5 39. The system of claim 13, wherein said annotation label manager comprises:
an annotation label generation control unit constructed and arranged to
instantiate and destroy label control units based on said create and delete function
calls; and
an annotation label maintenance unit constructed and arranged to maintain said
10 label state data structure, said maintenance unit receiving rendering information from
said graphical user interface and updating said label state data structure with such
information to maintain said annotation label current state.

40. The system of claim 39, wherein said annotation label generation control unit
15 is further constructed and arranged to store annotation label default values in a default
values data structure.

41. The system of claim 40, wherein said annotation label generation control unit
is further constructed and arranged to determine initial values for rendering an
20 annotation label.

42. A signal measurement system comprising:
an operating system;
a graphical user interface; and
25 an annotation system for graphically annotating measurement waveforms
displayed in a waveform display of the graphical user interface, said annotation
system constructed and arranged to enable an operator to graphically generate an
annotation label containing operator-generated information and to position said
annotation label to any location on the waveform display.

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43. The system of claim 42, wherein the operator can control appearance characteristics of said plurality of annotation labels displayed on said graphical user interface.

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44. The system of claim 42, wherein said location of said plurality of annotation labels includes positions that positionally associate said displayed annotation labels with a desired waveform or waveform feature displayed on said graphical user interface, and

10 wherein one or more of said plurality of annotation labels includes additional graphical elements to facilitate visual association with said desired waveform or waveform feature.

45. The system of claim 42, wherein said annotation system comprises:

15 a plurality of label control units each constructed and arranged to control operator interactivity with an associated annotation label rendered on the graphical user interface, said plurality of label control units providing the operator with the capability to determine content and display location of said associated annotation label; and

20 an annotation label manager constructed and arranged to provide centralized control over invocation and removal of each of said plurality of label control units and, hence, of said display of said associated annotation labels.

46. The system of claim 45, wherein said annotation label manager maintains, in a
25 label state data structure, a current state of each of said plurality of associated annotation labels currently rendered on said graphical user interface, said current state including said position, appearance and said content of said displayed annotation labels.

47. The system of claim 46, wherein said label state data structure is globally accessible to other elements of the signal measurement system.
48. The system of claim 42, wherein said annotation label manager is constructed and arranged to generate, in response to said creation and deletion function calls generated by said graphical user interface, system calls that cause an operating system to create and destroy specified ones of said label control units.
49. The system of claim 47, wherein said annotation label manager stores in a memory device default values for said location, said appearance of said content of said displayed annotation labels.
50. The system of claim 49, wherein said current state comprises:
a label number uniquely identifying each displayed annotation label;
a label pointer providing an address of said label control unit that generated said annotation label;
location information identifying a current location of said annotation label on the display; and
label content information identifying contents of said annotation label.
51. The system of claim 50, wherein said current state further comprises:
rendering information identifying an appearance of said annotation label when said annotation label is rendered on the graphical user interface.
52. The system of claim 45, wherein each said label control unit comprises:
a display controller constructed and arranged to interoperate with said graphical user interface to display and control said display and operator interactivity with said associated annotation label on said graphical user interface; and
a position controller constructed and arranged to control said location and size of said associated annotation label.

53. The system of claim 52, wherein each said position controller is constructed and arranged to determine a size and position of said associated annotation label to enable said associated annotation label to be completely rendered within boundaries of a waveform display region.

54. The system of claim 52, wherein each said label control unit further comprises: a command processor constructed and arranged to route certain function calls from said graphical user interface to annotation label manager and forwards certain commands to said display controller and to said positional controller.

55. The system of claim 45, wherein said annotation label manager comprises: an annotation label generation control unit constructed and arranged to instantiate and destroy label control units based on said create and delete function calls; and an annotation label maintenance unit constructed and arranged to maintain said label state data structure, said maintenance unit receiving rendering information from said graphical user interface and updating said label state data structure with such information to maintain said annotation label current state.

56. The system of claim 55, wherein said annotation label generation control unit is further constructed and arranged to store annotation label default values in a default values data structure.

57. The system of claim 56, wherein said annotation label generation control unit is further constructed and arranged to determine initial values for rendering an annotation label.

58. A method for graphically displaying modifying an annotation label on a graphical user interface;

- (1) displaying on a graphical user interface a display element representing adding an annotation label;
- (2) graphically selecting said annotation display element;
- (3) displaying, on the graphical user interface, a dialog box providing the
- 5 operator with the ability to enter a desired content to be displayed in the annotation label;
- (4) graphically entering data into said dialog box; and
- (5) displaying said annotation label on said graphical user interface.

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